<u>IN THE SPECIFICATION:</u>

Please replace the paragraph starting at page 2, line 8, with the following amended paragraph:

> a plurality of energy storage elements each having a different operating characteristic and connected in an electrical circuit to <u>the</u> [[said]] load; [[and]]

Please replace the paragraph starting at page 2, line 11, with the following amended paragraph:

> a circuit element interposed between at least one of <u>the</u> [[said]] storage elements and <u>the</u> [[said]] load and operable to segregate <u>the</u> [[said]] one of <u>the</u> [[said]] energy storage elements therefrom, <u>the</u> [[said]] circuit element being selected to match supply of energy to <u>the</u> [[said]] load to <u>the</u> [[said]] characteristics of <u>the</u> [[said]] storage elements<u>; and</u>

Please add the following <u>new</u> paragraph after the paragraph starting at page 2, line 11:

> a power monitoring unit to monitor at least one of said energy storage elements and vary the demand thereon from said load.

Please replace the paragraph starting at page 3, line 20, with the following amended paragraph:

Power pack (50) includes a power drive (52) which is itself connected to a power supply (54) to supply energy to actuating mechanism (62) in order to create the <u>required</u> ~~requirement~~ movements. The power supply (54) and power drive (52) interact through a saturation control line (916) to control the amount of power being provided by the power drive (52) to the actuating mechanism (62) through power lines (61). The power drive (52), may be for example, but ~~not limiting the current description~~ <u>is not limited</u> to the following model, a PIC25/50 from ELMO Motion Control<u>.</u>

Please replace the paragraph starting at page 4, line 8, with the following amended paragraph:

The current required for operation of the actuating mechanism (62) [[62]] may be divided in two major current profiles as shown on FIGS 4 and 5. A first current profile is a relatively high-frequency Pulsed Width Modulation (PWM) signal. The PWM signal is a high-efficiency control signal that has a wide spread use in motor control. The period of a PWM signal always remains the same, but the signal duty cycle (ON/OFF ratio) may vary over time as illustrated in FIG. 4. The outputs of the power drive (52) that feed the actuating mechanism (62) are of the PWM type. The required energy taken by the power drive (52) to fulfill this profile must come from the power supply (54).

Please replace the paragraph starting at page 4, line 17, with the following amended paragraph:

A second current profile is a low frequency one. It is the main current ~~envelop~~ that reproduces the amputee's gait or ~~amputees~~ movement, in the case of an active prosthesis (60). This profile, an example of which is illustrated in FIG. 5, may be relatively high current but of short duration and has a sine wave-like form on normal gait operation. It will be seen therefore that the current demands imposed on the power supply vary and to satisfy these demands[[,]]. The [[the]] power supply is organized as shown in greater detail in FIG. 2.

Please add the following new paragraph after the paragraph starting at page 4, line 17:

It is to be understood that like reference numerals refer to the same parts throughout the specification and drawings.

Please replace the paragraph starting at page 4, line 25, with the following amended paragraph:

The power supply (54) has energy storage elements of different characteristics, namely a battery (100), a super capacitor (200) and electrolytic capacitors (300). The storage elements are connected in parallel to the power drive (52) by a bus (59) connected to terminals [[56,58]] (56, 58). The first profile, the high-frequency Pulsed Width Modulation (PWM), is most suitably addressed by electrolytic capacitors (300), while the second profile, the low frequency one, is most suitably addressed by battery (100) and super capacitor (200). The storage elements are functionally segregated by an inductor (400) that is interposed in the bus (59) to limit the current flow from battery (100) and super capacitor (200) in specific cases, which will be discussed later. The inductor [[400]] <u>(400)</u> acts to delay the supply of current from the battery [[100]] <u>(100)</u> and superconductor [[200]] <u>(200)</u> and<u>,</u> accordingly current is supplied preferentially by discharge of the parallel electrolytic capacitors (300).

Please replace the paragraph starting at page 6, line 1, with the following amended paragraph:

Referring to FIG. 3, battery (100) includes 10 battery cells (110), such as high-energy density Lithium Polymer (Li-Pol) cells, for example, but ~~not limiting the current description~~ <u>is not limited</u> to the following model, SLPB36495-HD cells manufactured by Kokam Engineering. Battery cells (110) are configured serially, this arrangement allowing for a relatively high voltage to be used (nominal 37V, maximum 42V when fully charged) as well as allowing the use of high current (power). These cells (110) are well suited for the example application of an active prosthesis (60) in that they enable the discharge of high currents of up to 10 times (10C, where <u>C is the battery (100) capacity and</u> 1C mA = 2000 mA) the cell's (110) nominal one, or in any other applications requiring high peak currents. This performance enables a reduction in the number or required cells (110) inside the battery (100) because of the ability of the cells (110) to deliver higher currents than their nominal one. As well, it offers an advantageous volume-over-performance solution, and allows for a relatively compact design, which is an important factor in the case of an active prosthesis (60) or any other electric or electronic device having limited available space for a power supply.

Please replace the paragraph starting at page 7, line 5, with the following amended paragraph:

The battery cells (110) are monitored using <u>protection circuit modules (PCM)</u> [[PCMs]] (120, 130, 140 and 150), such as, for example, but ~~not limiting the current description~~ <u>is not limited</u> to the following model, MAX1666 PCMs manufactured by Maxim. An individual PCM (120, 130, 140 and 150) monitors an associated cell group (112, 113, 114 and 115), comprising 2 or 3 battery cells (110) in series, by measuring voltages, charge and discharge currents. In a charging mode, when a PCM (120, 130, 140 and 150) detects a noticeable voltage change or an over current condition, it protects the monitored battery cells (110) by disabling the use of its associated cell group (112, 113, 114 and 115) by controlling its associated charging protection switch (124, 134, 144 and 154) through respective control lines (122, 132, 142 and 152). During discharge mode, a detection of an adverse condition in one group of cells opens the discharging protection switch (164) to prevent further current supply. The PCMs (120, 130, 140 and 150) return[[s]] to bypass mode (switches closed) when associated cell groups (112, 113, 114 and 115) reach~~es its~~ their protection release voltage or current.

Please replace the paragraph starting at page 7, line 21, with the following amended paragraph:

A high-energy storage element, the super capacitor (200), is used ~~in order~~ to limit the peak current contribution of the battery (100). The super capacitor (200) can deliver high quantities of energy within a very short amount of time, which is a different behavior than that of the battery (100). Batteries are considered high-energy elements because they can store higher energy inside their volume but do not have the same ability to deliver it as quickly. Thus, high frequency in-rush [[high]] currents are partially delivered by the super capacitor (200), for example, but ~~not limiting the current description~~ is not limited to the following model, a THQ3050243 from Evans Capacitor. It has been evaluated that 24 mF were sufficient for the example application.

Please replace the paragraph starting at page 8, line 1, with the following amended paragraph:

Special care should be taken regarding the super capacitor's (200) Equivalent Serial Resistor (ESR) as it should be kept as low as possible. The expected values for one super capacitor (200) should stand in mΩ and lower than 1Ω for the whole group in the case [[were]] where multiple super capacitors (200) are used. High ESR results in lower instantaneous available current, which means that the battery (100) would have to provide a higher current contribution.

Please replace the paragraph starting at page 8, line 8, with the following amended paragraph:

The electrolytic capacitors (300) are high-energy storage elements used ~~in order~~ to limit the peak current contribution of the battery (100) as well as for PWM filtering. Similarly to the super capacitor (200), the electrolytic capacitors (300) can deliver high quantities of energy within a very short amount of time, which is a different behavior than that of the battery (100). Thus, ~~higher~~ high frequency in-rush [[high]] currents are partially delivered by the electrolytic capacitors (300), for example, but not limiting the current description to the following model, EEUFC1J471L capacitors from Panasonic. In the ongoing example, for volume considerations, the use of smaller electrolytic capacitors (300) has been preferred, in this case capacitors having an individual capacity of 0.47 mF for a total capacity [[is]] of 2.82 mF (six electrolytic capacitors (300) in parallel). Additional benefits come from this paralleling of the electrolytic capacitors (300), notably the ESR is reduced by a factor of six while the capacity and maximum current are increased by a factor of six.

Please replace the paragraph starting at page 8, line 23, with the following amended paragraph:

As noted above, the energy storage elements with the different characteristics are segregated by the inductor (400). The role of the inductor (400) is to delay and therefore limit the current contribution of the battery (100) and super capacitor (200) when peak high–frequency current conditions occur. The inductor (400) is located between power drive (52) and super capacitor (200) because the power drive (52) potentially induces high frequency noises (and therefore currents) and super capacitors do not perform well under high frequency conditions. Inductor (400) plays the same role for the battery (100). Enough inductance should be used in order to allow an acceptable contribution limitation of the low-frequency sub-system, i.e. battery (100) and super capacitor (200). By reducing the current contribution of the low-frequency sub-system, battery (100) and super capacitor (200), the inductor (400) forces the electrolytic capacitors (300) to deliver their energy into power drive (52). In the example application of an active prosthesis (60), the inductor (400) may be, for example, but ~~not limiting the current description~~ is not limited to the following model, a DC780-153K inductor from API Delevan. It should be noted that the selected inductor (400) must have an incremental current value that matches the application's worst-case current, which is approximately 18A in the given example.

Please replace the paragraph starting at page 10, line 9, with the following amended paragraph:

When charging the super capacitor (200) and electrolytic capacitors (300) from the battery (100), for example when the power supply (54) is powered on after a certain period of inactivity having had for effect the full discharge of the super capacitor (200) and electrolytic capacitors (300), a very high and fast power drain is experienced by the battery (100). This results in a power drain which may exceed[[s]] the maximum allowable power available, thus causing the PMU to disconnect the battery (100) from the bus (59) in order to protect the battery (100) from an over discharge situation. To prevent such a situation from happening, a slow in-rush limiter (700) and a fast in-rush limiter (800) limit in time the current drain of the super capacitor (200) and electrolytic capacitors (300), respectively, on the battery (100).

Please replace the paragraph starting at page 10, line 20, with the following amended paragraph:

The slow in-rush limiter (700) and [[a]] fast in-rush limiter (800) may be based, for example, on N-Channel D^2PAK power mosfets that will let the voltage increase linearly across the super capacitor (200) and electrolytic capacitors (300), respectively. A simple way to proceed is to adjust the charging time <u>so as</u> to <u>obtain</u> a nearly steady-state acceptable power.

Please replace the paragraph starting at page 12, line 16, with the following amended paragraph:

At block (932), the algorithm checks if the weighted voltage, Vbat(weighted), is below a minimal acceptable voltage, <u>Min</u>Vbat(acceptable), which is a threshold indicative of a minimal operationally safe voltage level below which damage may start accruing to the battery (100) or some of its constituent battery cells(110). If Vbat(weighed) is below <u>Min</u>Vbat(acceptable), then, at block (933), the algorithm opens the discharge switch (164), through discharge switch control line (914), so has to disconnect the battery (100) from the bus (59). On the other hand, if Vbat(weighed) is not below <u>Min</u>Vbat(acceptable), then, at block (935), the algorithm closes the discharge switch (164), through discharge switch control line (914), so as to connect the battery (100) to the bus (59).

Please replace the paragraph starting at page 12, line 26, with the following amended paragraph:

At block (936), the actuating <u>mechanism's</u> ~~mechanisms~~ (62) power saturation level, PMaxSat, is computed by multiplying the difference between the weighted voltage, Vbat(weighed), and the minimal acceptable voltage, <u>Min</u>Vbat(acceptable), by transfer function G(S) which implements a current regulator. FIG. 8 shows a block diagram of the G(S) transfer function in which:

Please replace the paragraph starting at page 14, line 4, with the following amended paragraph:

The algorithm then sets the actuating <u>mechanism's</u> ~~mechanisms~~ (62) power saturation level of the power drive (52), at block (938), by sending a power saturation command, PMaxCMD, to the power drive (52) through power saturation control line (916).

Please replace the paragraph starting at page 14, line 7, with the following amended paragraph:

At block (940), a low pass filter is applied to PMaxSat, the purpose of the lowpass filter is to introduce a certain delay in time so as to eliminate[[d]] small rapid variations in the PMaxSat values. Following the low pass filtering of PMaxSat, at block (942), the transfer function G(S) is dynamically adjusted in response to the available power.

Please replace the paragraph starting at page 14, line 12, with the following amended paragraph:

Typically, the DSP (910) requires a single 3.3V and a dual +/-12V power supplies to operate. This power may be provided by converting a portion of the power drive's (52) available power into the required DSP (910) power levels using a DC/DC converter (950), for example, but ~~not limiting the current description~~ <u>is not limited</u> to the following model, a DATEL TWR-3.3/4-12/300-D4. An advantage of using a DC/DC converter (950) is the possibility of isolating the DSP (910) from the power source, i.e. the battery (100). Other possible approaches would be to make an equivalent converter using discrete electronic elements, instead of a modular block, integrated as a converter or having an additional power supply dedicated to the DSP (910).

Please replace the paragraph starting at page 14, line 22, with the following amended paragraph:

Regarding the warning to user when approaching end of autonomy time of the battery (100), an audio warning (960) and/or an LCD display (970) may be implemented as a two-level configuration: a first warning indicating that the battery's (100) power is getting low; a second one indicating that the battery's (100) power is nearing a "critical power failure" condition. For example, the first warning may be issued when the PMU (900) estimates that battery (100) has a power reserve sufficient to operate for a further 30 minutes until total discharge (under normal operating conditions), while the second warning may be issued at 10 minutes before total discharge.

Please replace the paragraph starting at page 15, line 3, with the following amended paragraph:

In operation ~~therefore~~, the battery (100) is initially charged using the connector (170). The cells (110) are monitored by the PCM's (120, 130, 140 and 150) and isolated from the charger (170) when fully charged. Upon the prosthesis being activated, the super capacitor (200) and electrolytic capacitors (300) are charged from the battery (100) with the in rush limiters (700 and 800) limiting the drain on the battery (100).

Please replace the paragraph starting at page 15, line 9, with the following amended paragraph:

The initial locomotion of the amputee is secured by the sensors (42) and generates a control signal at the controller (46) to initiate the operation of the actuating mechanism (62). The power drive (52) determines the current required up to the maximum indicated by the saturation control line (916) and connects the power supply (54) to the mechanism (62). The electrolytic capacitors (300) provide the higher frequency components of the current supply with battery (100) recharging the electrolytic capacitors (300) as limited by the fast in-rush limiters (800). The inductor (400) inhibits current flow from the battery (100) and super capacitor ~~conductor~~ (200) so that the demand is met by the electrolytic capacitors (300).